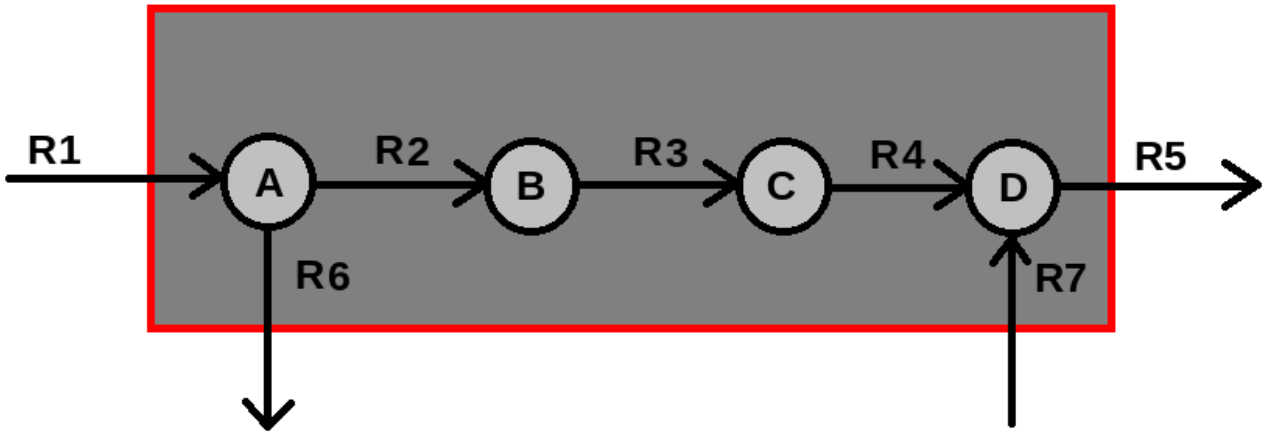
Model:



rfile:

```
"R1" "R2" "R3" "R4" "R5" "R6" "R7"
```

mfile:

```
"A" "B" "C" "D"
```

sfile:

```
 1 -1  0  0  0 -1  0
 0  1 -1  0  0  0  0
 0  0  1 -1  0  0  0
 0  0  0  1 -1  0  1
```

rvfile:

```
0 0 0 0 0 0 0
```

tfile:

```
1 0 0 0 1 0 0
```

MILP3(E^i): min 0

s.t.

$$
\begin{aligned}
S*v &= 0,\\
v_{r1} &\geq 1,\\
v_{r2} &\geq 1,\\
a_l &\leq v_l,\\
v_l &\leq M_0*a_l,\\
S^T*y + u^{r1}*x &\geq M_1*(a - \mathbf{1} - u^{r2}),\\
-x &\geq 1,\\
\Sigma_{l \in supp(eq)} a_l &\leq |supp(e^q)| - 1,\\
v_l &> 0,\\
a_l &\in \{0,1\},\\
x, y_m &\in \mathbb{R}
\end{aligned}
$$

MILP3(E^i) for first iteration which is characterized by an empty set E of elementary modes:

```
\ENCODING=ISO-8859-1
\Problem name: perlOP

Minimize
 obj:
Subject To
 t_lt_Mz_0:     v_R1 - 100 a_R1 <= 0
 t_lt_Mz_1:     v_R2 - 100 a_R2 <= 0
 t_lt_Mz_2:     v_R3 - 100 a_R3 <= 0
 t_lt_Mz_3:     v_R4 - 100 a_R4 <= 0
 t_lt_Mz_4:     v_R5 - 100 a_R5 <= 0
 t_lt_Mz_5:     v_R6 - 100 a_R6 <= 0
 t_lt_Mz_6:     v_R7 - 100 a_R7 <= 0
 z_lt_t_0:      - v_R1 + a_R1 <= 0
 z_lt_t_1:      - v_R2 + a_R2 <= 0
 z_lt_t_2:      - v_R3 + a_R3 <= 0
 z_lt_t_3:      - v_R4 + a_R4 <= 0
 z_lt_t_4:      - v_R5 + a_R5 <= 0
 z_lt_t_5:      - v_R6 + a_R6 <= 0
 z_lt_t_6:      - v_R7 + a_R7 <= 0
 avoid_trivial: a_R1 + a_R2 + a_R3 + a_R4 + a_R5 + a_R6 + a_R7 >= 1
 A:             v_R1 - v_R2 - v_R6  = 0
 B:             v_R2 - v_R3  = 0
 C:             v_R3 - v_R4  = 0
 D:             v_R4 - v_R5 + v_R7  = 0
 vr_0:          v_R1 >= 1
 vr_4:          v_R5 >= 1
 ST_Dirc_R1_R5: - 101 a_R1 + y_0_A + x_0 >= -101
 ST_Dirc_R1_R5: - 101 a_R2 - y_0_A + y_0_B >= -101
 ST_Dirc_R1_R5: - 101 a_R3 - y_0_B + y_0_C >= -101
 ST_Dirc_R1_R5: - 101 a_R4 - y_0_C + y_0_D >= -101
 ST_Dirc_R1_R5: - 101 a_R5 - y_0_D >= -202
 ST_Dirc_R1_R5: - 101 a_R6 - y_0_A >= -101
 ST_Dirc_R1_R5: - 101 a_R7 + y_0_D >= -101
 x_R1_R5:       - x_0 >= 1
Bounds
 0 <= a_R1 <= 1
 0 <= a_R2 <= 1
 0 <= a_R3 <= 1
 0 <= a_R4 <= 1
 0 <= a_R5 <= 1
 0 <= a_R6 <= 1
 0 <= a_R7 <= 1
      y_0_A Free
      y_0_B Free
      y_0_C Free
      y_0_D Free
      x_0 Free
Binaries
 a_R1  a_R2  a_R3  a_R4  a_R5  a_R6  a_R7
End
```

Solution computed by CPLEX:

```
v1  v2  v3  v4  v5  v6  v7    a1 a2 a3 a4 a5 a6 a7   yA  yB  yC  yD    z
1.0 1.0 1.0 1.0 2.0 0.0 1.0   1  1  1  1  1  0  1    1   1   1   101   -1
```

Stoichiometric matrix S^1 of subnetwork N^1:

```
1    -1    0    0    0    0    0
0    1    -1    0    0    0    0
0    0    1    -1    0    0    0
0    0    0    1    -1    0    1
```

LP(N^i): min 0

s.t. $S^i * v = 0$,

$v_{r1} \geq 1$,

$v_j \geq 0$,

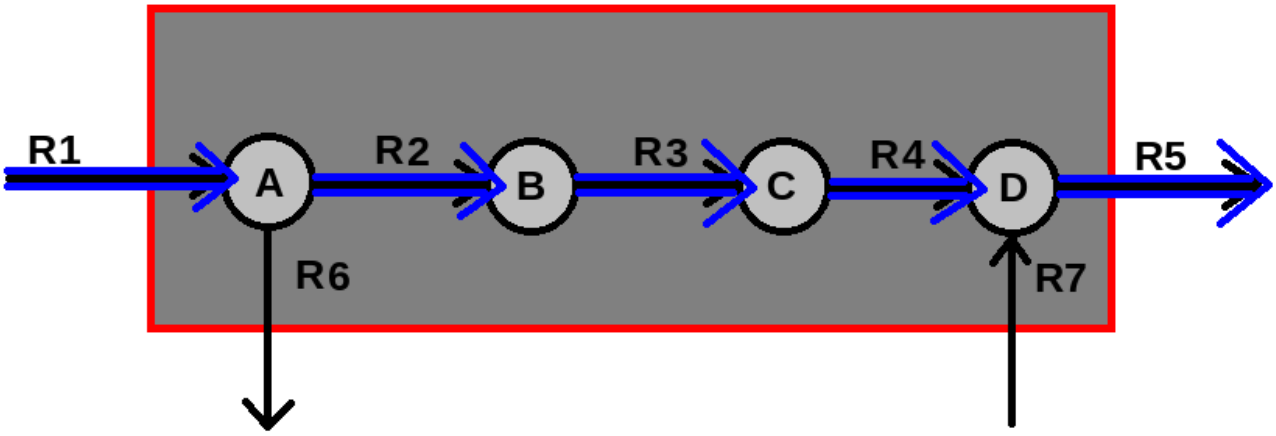
LP(N^1) solved by CPLEX:

```
\ENCODING=ISO-8859-1
\Problem name: perlOP

Minimize
 obj: 0
Subject To
 A: v_R1 - v_R2  = 0
 B: v_R2 - v_R3  = 0
 C: v_R3 - v_R4  = 0
 D: v_R4 - v_R5 + v_R7  = 0
 vr_0: v_R1 >= 1
End
```

Solution computed by CPLEX:

```
v1    v2    v3    v4    v5    v6    v7
1.0   1.0   1.0   1.0   1.0   0.0   0.0
```



Question:

CPLEX could also find the following solution for LP(N^1), as there is no objective function given:

```
v1    v2    v3    v4    v5    v6    v7
1.0   1.0   1.0   1.0   2.0   0.0   1.0
```

```
Minimize
 obj: 0
Subject To
 A: v_R1 - v_R2  = 0          => 1 - 1 = 0
 B: v_R2 - v_R3  = 0          => 1 - 1 = 0
 C: v_R3 - v_R4  = 0          => 1 - 1 = 0
```

```
 D: v_R4 - v_R5 + v_R7  = 0   => 1 - 2 + 1 = 0
 vr_0: v_R1 >= 1              => 1 >=      1
End
```